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Multiplying Gear and Worm-Drive.

The several drawings are views of a very ingenious invention for multiplying gear, by Frank Dillion and Lewis Robinson, of New City (N. Y.) for which a patent was granted on the 15th of last month, the claim of which was published on page 2067 and under which we stated that "an engraving of the invention would soon be presented."

The drawings represent three different forms of the gearing. Figure 1 is a front view of a gear for multiplying the speed of the driving shaft 100 times, figure 2 is a longitudinal section of the same, figure 3 is a longitudinal section of another form of the gearing, and figure 4 is a vertical section of a worm gear to which this gearing is applied. The same letters refer to like parts.

In figure 1 and 2, A is a stationary ring having eleven teeth on its inner periphery. B is an internal wheel with 10 teeth; it is fastened on the shaft, G, which is capable of revolving in the casing, C, C is an external wheel with ten teeth passing into A, and D is another wheel smaller to C, but having nine teeth gearing into B. The wheels, C and D are connected together by curves, e e e. F is a small shaft, revolving in the casing, C, of the rings, A and B, in crank pin, F, is connected loosely to the center, f, of the wheel C, so that when the crank revolves, the center, f, is carried in a circle around the center, e, whereby the teeth of the wheel will be constantly kept in gear with the teeth of the ring, but the actual point of contact is constantly changing.

Let us first examine the action of the pair, A and B. The wheel, B, having one tooth less than A, will after one revolution of the crank (suppose in the direction of the arrow, I, when the active periphery of A, and hence is carried with the periphery of C) have revolved in an opposite direction to the motion of the crank, through the negative difference of one division of its pitch, so that the position of the line, f, will have changed to f'—the angle, f' f, representing the angular motion of C, after one revolution of the crank.

We will now explain the action of the second pair, B and D. Suppose that the wheel, D, is incapable of revolving in space, although the center, f, is revolving with the crank, so that a line, g h, (taken through the center, f, of D, is in every position of the crank constantly vertical. The wheel, B, being capable of revolving, will now turn in the same direction as the crank, the distance being also one division of its pitch; the line, e g, will therefore after one revolution of the crank, be in the position, e i; g e i being the angular motion of B. But D being fastened to C, will not be in the condition we have above assumed, it will, by the action of the gear, A and B, as above explained, be revolving at the same time when the angle, f' f, is describing in an opposite direction to the angular motion, e g, of the wheel B, consequently the real motion of B will only be the difference between these two opposite motions, which is represented by the angle, h e i. Let n = f e d represent the number of teeth of the diameter of the

MULTIPLYING GEARING.

Figure 1.

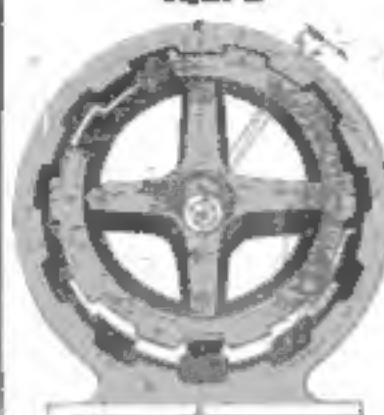
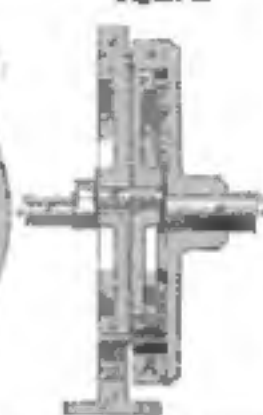


Figure 2.



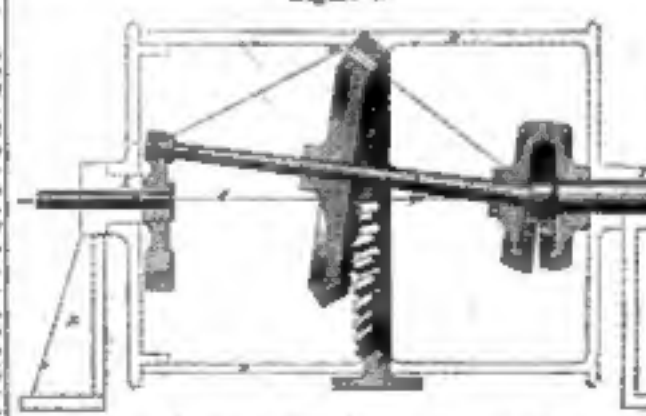
wheel, A, B, C, D, then the relative speeds of the wheel, B, and the crank is represented by the following proportions:

Angular speed of B : angular speed of crank :: 10 : 1. Substituting the number of teeth in an example we obtain $10 \times 10 = 11 \times 10 = 110$. Consequently the crank, B, will revolve 110 times when B revolves once.

When the centers, e and f, are placed as in the figures 1 and 2, the difference between the diameters of A and C must be the same as between B and D, so the wheels would not gear; the length of the crank at the distance between the centers, e and f, must also be equal to one-half the sum of the diameters between each pair of wheels, but if these two sums are arranged so to meet in one point, the relative difference between the diameters of the wheels of each pair, and the relative distance of centers, e and f, will vary according to the distance of which the wheels are placed from the point of meeting of both sets, not to the angle at which the same are placed to

each other. In figure 1 e e and f f, represent the axes of the wheels, which meet in the point, e. In every other gear the centers of the teeth must represent part of a cone which has its apex in the meeting point, e, consequently the wheels must now be level wheels, A is the stationary ring; C is the wheel gearing with A, and fastened on the shaft, G, which runs with its splines and in e, is a corresponding wheel at the extremity of the shaft, G, the other end of F, is loosely connected with the crank, I, revolving with the shaft, B, so that when the crank revolves, the shaft, F, must also revolve around the line, e, giving directly to the wheel, C, a positive rotating motion, by which the teeth of C, will be brought continuously in gear with those of A. The action of this pair is exactly the same as that above explained for the same pair in figures 1 and 2, namely, the wheel, C, will revolve in an opposite direction to the motion of the crank. We may now place the second pair, B and D, having any other difference of diameters, of such a dis-

Figure 3.



tance from the point, e, when the distance, e g, between the axes, e f, is just equal to one-half the difference of the diameters, the sum of the diameters, the same must they be placed to e, and if this is not, or if they are both of the same diameter, the position will be at the point, e, where the axes, e f, meet, which is the case in figure 2. The increase of speed is here due only to the gear, A and C, while B and D are only for the purpose of transmitting the revolving motion of F to C, allowing at the same time the other extremity of F, to take the circular motion around e. In this case the speed of the crank is e to the difference of diameters of A and C is to the diameter of the revolving wheel, C, which is

in the foregoing at 1 : 2, consequently when C revolves once B revolves 2 times.

This form of gearing the patentees believe is well adapted for multiplying the speed of a propeller shaft, when the driving shaft can be put in the same line with the propeller shaft, which is usually the case in sailing machines. It requires great care of motion with strength, and requires but little space or number of teeth being required in comparison with other gears, and would occupy that position in ships which is the most advantageous.

To show how this gear can be applied to existing apparatus, reference is had to the detailed section line in figure 2. Suppose H to

be the cylinder on which the rope is to be wound revolving on the supports, J and K, and also the ring, A, to be cast with this cylinder in one piece. The shaft, G, is fastened to the support, J, so that the wheel, B, is now stationary, or G may also be connected with a fixed wheel, by which it is kept stationary or made to slip. If the rope was to be wound, when the crank shaft, E, which passes through the support, L, is turned, the ring, A, and with it the barrel, B, will turn in the same direction as the crank, the difference of speed being as 1 : 2, in this case, but any greater difference may be obtained by increasing the diameter of C. It will be seen by this arrangement that all the machinery is inside the barrel, B. When the wheel, B, is of equal diameter, their action will be equal in that of a universal joint, the latter may therefore then be substituted for B and D. Such an arrangement is shown in figure 4, which represents the vertical section of a Worm Gear as exhibited at the Crystal Palace.

A is a stationary barrel gear with 84 teeth, the action being drawn in the direction of the meeting point, e, at the axes e e and f f. G is a stationary hollow shaft, being connected to the wheel, A, by six arms, e e, all being cast in one piece. On this shaft revolves the plate, B, in which the bars are connected by means of levers, I, instead of H; D is a universal joint ring, which is connected to B, by means of two pins, e d, which rest in outside bearings in B, so that D keeps freely on these pins; C is a toothed ring with 21 teeth gearing into A, which is connected with D also, by two pins, e d, one of which supports the axis in the section in dotted lines (see e f) to the ring, B, in the same manner as D is connected to B, both connections being at right angles to each other. This connection forms a universal joint, and allows the ring, C, to make that peculiar action, as C in figure 2, keeping it of the same line in connection with B, so that B cannot revolve without C revolves with it; E is a shaft which passes through G, to which is connected the crank, I; D is a cross-piece fastened to the crank-pin, F, which is connected by four bars, e e e e (shown only one need) to the ring, C, into which the bars are cast. These bars in connection with I, represent the shaft, F, in figure 2, and are for the purpose of executing the axis f f of C, with the crank. When force is evenly applied to B, it is transmitted to C, which, by gearing into A, tends to draw the axis f f, around the axis, e e, of the wheel A. This action will be more clearly understood by reference to figure 2. If we suppose e m f e to be a triangle resting at m, while at e force is applied, which tends to turn it around the line e f. Now as the axis, m, is supported, it can only turn around the line, e f, while e f will make a sideward motion, but as f is fixed by the crank to move in a circle around e e, instead of around e m, the triangle will be drawn out of connection with the rest at m, while another such triangle is drawn in connection with another rest. Supposing now the wheel, C, to consist of a series of such triangles arranged around the axis f f, and the ring, A, another series of supports, the action of this gear will be easily understood. The speed obtained by the above arrangement is as 1 to 20, or that the pulley, K, which is fastened on the shaft, E, will make 20 revolutions for one of B. The inventors generally apply, in place of the pulley, K, a barrel wheel which gears into another at half the diameter, on a horizontal shaft, so that the increase of speed is as 1 to 100. The diameter of A to be two diameters in only 21 inches. If it is required to transmit the motion to the upper part of a building, then they engage with

(Continued on Second Column of next Page.)

Scientific American

NEW YORK, SEPTEMBER 14, 1883.

To Our Subscribers.

This number being the last of the present volume, our task will be the last of volume nine, *Scientific American*. We return your sincere thanks to you, our subscribers, for your good will and energetic support of a journal devoted to the arts, sciences, and inventions of our country; "your health has filled our sails." With no small degree of pleasure we acknowledge the addition of between three and four thousand new subscribers to volume eight, and we hope that as many more will become new subscribers to Volume Nine. It is well known to our readers that as our circulation has increased, we have added improvements to our paper; this will always be our policy, and our next volume will therefore be superior to all that have preceded it. Our circulation nearly twenty thousand, and copied in greater than that of any paper of the kind in the world. Our long experience, and our facilities for obtaining the most important information about inventions and discoveries in all parts of the world, and the number of our practical correspondents, give us superior advantages for presenting the most reliable and earliest information upon every subject new and useful relating to inventions and discoveries. Our advertisement page is of great benefit to our readers and those who advertise, as it presents information where articles of machinery and various manufactures are made and sold. We receive from the Patent Office the official list of patents, with the claims entered, and publish them every week. All patents for the invention of patents, are now published by us officially, the *Scientific American* having been appointed by Judge May, as the most suitable paper for that purpose in the country, it having the largest circulation among inventors, and those interested in American patents.

Considering the number and condition of our illustrations, the quality and importance of the information contained in our volumes, the *Scientific American* is the cheapest and best mechanical paper in the world. We hope to continue the success of all our present subscribers on our limits. We have confidence in the good will and the desire of our intelligent subscribers to spend useful information, that as inventors we anticipate a large increase of new subscribers from your labors. If every subscriber could get an other one, what a splendid paper we would present the coming year, this can be done and both you and it would be the gainers; you are depend upon it, that at any rate our next volume will be the best for which you have not subscribed.

An Independent Illustrated Paper.

There is a real solid pleasure in doing our duty. Whoever on earth is cramped up by any considerations—either those of ignorance or selfish interest—that prevent him from speaking his sentiments freely, he is certainly placed in a very uncomfortable position, for he is nothing but a prisoner in ideas, and his lucubrations become as tame, insipid, and uninteresting as the actions and words of any man placed under tutelage. As no man can be a safe leader of the people unless he is guided by confidence in himself, and in the strength of his cause, so no editor can be a safe guide unless he is impressed with the same feelings, and impelled with the like motives. It has always been difficult for truth to find its way into public notice, because it is surrounded with so much that is false, that people are either too stupid on the one hand, or too readily deceived—owing to their want of knowledge—on the other. It is vain to say, "we live in an enlightened age, and the people are too intelligent to be deceived now by plausible deception." There were a time in the history of the world when there was a greater necessity for a paper devoted to the analysis of new inventions, than there is at present. We have had too many glaring instances of ignorance in science, invention, and the arts, by those who are called

"enlightened" within the past year, not to be a warning to all of the way whereby the public may be easily deceived by those who are ignorant of such things. It is impossible for a man to be well informed about inventions now unless he makes them the business of his life; hence the necessity of a paper devoted exclusively to science and the mechanical arts. No man can now be intelligent either, in respect to science and the arts, unless he reads and studies such a paper. No teacher, except those relating to the word well-being of the soul, are so important as those relating to science, philosophy, and the arts; he that is ignorant of them is ignorant indeed.

We cherish the progress of discovery, and are happy to build new and useful improvements, and rejoice in the success of their authors; at the same time we know that the greatest obstacle to the progress and introduction of useful inventions, are those plausible and deceptive schemes—of no worth to themselves—by which the public are so often deceived under the name of "new and wonderful inventions." Beware of us! we feel on this point, and thereby therefore do we battle against the wrong, however strongly it may be supported, either by Scientists and Captains of the Navy, wealthy merchants, railroad directors, and the public press in general. As our readers have seen, to shall it be, for we have more than ever, within the past few months, all the importance—for the benefit of our people, and the honor of our country—of a useful and independent mechanical press, one that has a practical acquaintance with science and mechanics.

Look Back.

It is time to review the past, and that not infrequently, for experience is the best of all teachers; the scholar, however, who pays no attention to his lessons cannot be expected to acquire knowledge and wisdom. During the past year nearly very important improvements and discoveries have been illustrated and described in our volumes, and the claims of every patent issued from the United States Patent Office for the past twelve months is recorded forever within the folds of this volume. No less than 435 beautiful engravings have illustrated the pages of this volume, which is an average more than eight for each number. The majority of the cuts are large—some of your average magazine articles—many of them being three and four columns wide, and the attention they are the finest wood engravings of machinery to be found in books or periodicals in our country. We cannot commend the subjects which we have illustrated, but let our readers, as we have said before, look over their pages, and service them once more, and they will find more than they ever the face of that truth—universally acknowledged—the *Scientific American* is the Repository of American Inventions.

Diving bells, gold seekers, boring wells, atmospheric telegraphs, sewing machines, rubber wheels, truck drills, plows, plowing and sowing machines, steam engines, direct, reversing machines, rasps, boring, and washing machines, grain dryers, flourers, steam grinders, steam locomotives, new railroad improvements, and a great many other subjects have been illustrated in this volume.

Much valuable information has been presented, and no new scientific subject of importance has escaped attention.

In this volume our readers have our essays and illustrations of that stupendous iron steamer in engineering, the *Atlantic ship*. In the month of last February, our whole country, accepting sensible readers, was excited and the past in this respect is fixed, the wisdom in the fabric. We venture to assert, without any fear of contradiction, that every one of our readers has in volume eight, received more information, of more value to him than the price of his subscription, and which he could obtain no where else, and so truth is incontestable, such information is invaluable for all time. The *Scientific American* is not like a mere newspaper, every volume is useful for reference, and will be more useful twenty years hence than now; it is an encyclopedia of useful information.

The Crystal Palace.

The Crystal Palace for the first time was kept open for evening exhibitions on Friday

the last last. The machinery is now running, though this department is not yet filled up, but soon will be. There is much that is interesting, new, and useful, and much good judgment has been displayed by the Superintendent, Mr. Nelson. We can say but little on the subject this week, but we will illustrate many of the machines by-and-by, and will let our readers mostly of situation escape our notice.

The Picture Gallery is now open and contains some good pictures and some wonderfully poor ones.

The American department presents a grand deal of which we have just room to feel gratified.

There has been much talk among our citizens of reducing the price of admission to 25 cents. We think the Association would make more money if such a reduction was made, but the present price is not high for what is to be seen and learned; say, it is low indeed, every visitor will get the full value of his money. There are our minds and bodies who live at a distance, and who have delayed coming to the exhibition till things were in better order, will not be disappointed now, even when they visit.

We have not room to make any further comments this week, but our future numbers will contain descriptions and just criticism of everything worthy of notice in the Palace. Our comments will be useful for reference and guidance to all our readers.

From Miss Thompson.

[CONTINUED.]

[THE NEW YORK PALACE, Sept. 1st, 1883.]

The portion which has heretofore prevented us from writing, of having the address of the applicant for a patent on one piece of paper and the signature to the specification on another, so that both may be detached and applied to other papers, is deemed highly improper, and will not hereafter be tolerated. In such cases specifications will not from this time forth be received unless attached together by a tape, both the ends of which are secured by the seal of the office who administer the oath, or something equivalent thereto, so as to prevent the possibility of removal and substitution. This rule will not, however, be insisted on in cases where the oath and specification are written on the same paper continuously, even although they occupy more than one sheet, but in that case the officer administering the oath must adhere his name on every separate piece of paper on which the oath and specification are written.

Yours respectfully, CHAS. HENRY, Commissioner.

Improvement Suggestions.

Correspondents should give us their names and addresses in full, then there will be no mistake in sending the paper. Letters not signed are received as anonymous. Receipts cannot be sent by mail, if the paper is received it is sufficient evidence that the money has reached us. Volume are substantially and carefully bound at this office for 75 cts. each. Missing numbers ordered are always sent when they can be supplied. The paper is always stopped when the sum of pre-payment expires, we show no partiality in this respect, the rule is inflexible, and the only way by which useful substitution is avoided. Our dollar is charged for a copy of any claim granted within the past twelve years. Engravings of new inventions now prepared and published in this paper at the low cost of preparation, they belong to the inventor after publication. Volumes 4, 7 and 8 can be had bound \$2.50, or else in 60. Contributions of a practical character are solicited for publication, they should be as brief as possible, and pertinent to the point under consideration and accompanied by the real name of the author.

Notes—No Oath.

We have had a number of letters asking "if a club could be made up and the papers sent to different sets of officers." We answer, yes. All the sets should sent in a club not confined to the real names, although their papers may be sent to different post offices. Let the name and addresses of each be made and plugs sent off.

Lead Pipes and How to Use Them.

Dr. Wm. H. Elliot, of this city, has published a number of communications in the New York Tribune and the Times, on the evils of lead pipe, and the remedy for the same. As these communications have been published in advertisements, there must be a great amount of benevolence in the man who paid for them, and who has been at the expense of gathering so much information on the subject, if he has done so for the simple purpose of benefiting our citizens. He has published letters from Drs. Hall, Parker, Davis, Clark, and Gilman, wherein they state that venereal diseases have greatly increased in this city, and this is attributed to the use of lead pipe in conducting the water which is generally used in this city, for domestic purposes.

The machinery which Dr. Elliot proposes to show the injurious effects of lead pipe in conducting water is very strong, and this, together with his own experiments and analysis, in detecting the lead in the water, is something for the serious consideration of our people. The remedy which he proposes is the substitution of black tin pipes for those of lead. It is not the first time that this same subject has engaged the attention of our people, and like every other one, different notions have had different opinions about it. To avoid the evils of lead pipes, Dr. Kewick (Ex-Commissioner of Patents) look out a patent a number of years ago, for coating the interior of lead pipes with tin. If this invention will answer every purpose, we do not see why we are making the whole pipe of black tin, which is so much more expensive than lead. Indeed, we do not see what is to prevent the use of small cast-iron pipes for conducting our water. They can be coated inside with glass enamel, and should answer as good a purpose as pipes made entirely of black tin. Perhaps Dr. Elliot has no interest in saving his pipe manufacturing.

Attention! Attention! for the Advancement of Science.

It is not in our power to give an abstract in this number of any of the papers read; the last number therefore contained all that we felt it proper to publish at present. The proceedings, as has been customary heretofore, will be published by the city in which the Association met, and those of our readers who desire to obtain them must consult the subscription of Cleveland. We must say that we have a highly small opinion of the liberality of the Association at those cities in which the Association has heretofore met in respect to the printed proceedings, Albany for instance.

A good many of the papers read at Cleveland contained so practical information; however, indeed, we must say that the discussion or expounding formed the principal part of the proceedings. It is to be regretted that so much stuff is mixed up with the wheat.

To Our Correspondents.

Writing to the length of our excellent index, we are not able to devote our columns to answer to you. In our next number you will receive proper attention.

Gold's Patent.

Judge Moore, the Commissioner of Patents has refused to grant an extension of Gold's patent, for his repeating fire-arms. Reason, "the invention has been sufficiently anticipated."

A New Patent Office Appointment.

Edward Stone, of Connecticut, has been appointed to a \$1,200 clerkship in the Patent Office, made vacant by the promotion of Dr. Fortson to be an Assistant Commissioner.

Printer's Monthly.

We believe this magazine to be the best and cheapest monthly published in this country. The September number is issued, and is it is only equal to the performance in a reprint of correspondence to H. G. P. Parsons & Co., publishers, 15 Park Place.

Improvement in Velocipeds.

James Greenhill, of New York City, has invented an improved velocipede, or vehicle to be moved by the rider. The velocipede is supported by the feet placed in stirrups, and moving alternately as in walking. Maximum speed, being taken to secure a patent.

